FUJITSU SEMICONDUCTOR
DATA SHEET

DS04-29113-4E

ASSP

BIPOLAR

1A Motor Drive IC for Motor Applications

MB3853

■ DESCRIPTION

The FUJITSU MB3853 is a motor drive IC with two power driver channels capable of sink/source operation, for use in two-channel independent operation or H-type drive operation.

The control system and output system have independent power supplies, allowing the control system to be set to low-voltage operation to conserve power.

Protective circuits are provided for temperature, overvoltage, and overload current, with an open collector type monitoring terminal.

The MB3853 is designed for use with motors in AV products, office automation products, or cameras, and is also an ideal IC for use in automated vending equipment and other unmanned operating devices.

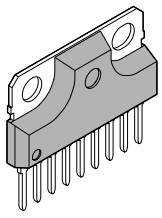
■ FEATURES

- Circuit configuration
  Two sets of built-in control circuits and power circuits
  Built-in fly-back diode
- Functions
  Can drive two motors independently or in H-type drive configurations
  Built-in inhibitor function

(Continued)

■ PACKAGE

Plastic SIP, 9 pins



(SIP-9P-M02)

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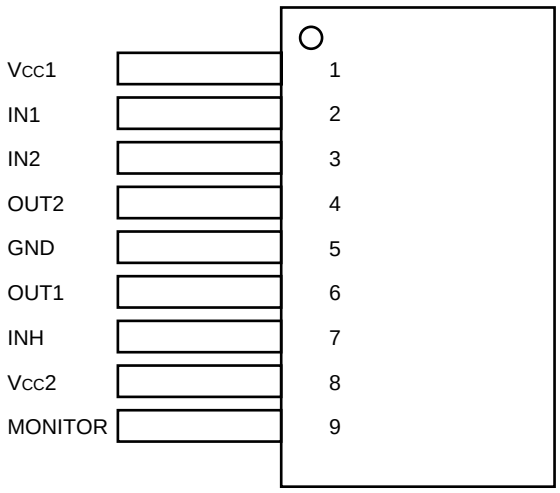
- Input/output terminals
  Power supply terminals : Independent control system supply terminal and output system supply terminal
  Control terminals : TTL level/CMOS level compatible
  Monitor terminal : Open collector type
- Space-saving package (SIP9)

■ PIN ASSIGNMENT

(FRONT VIEW)

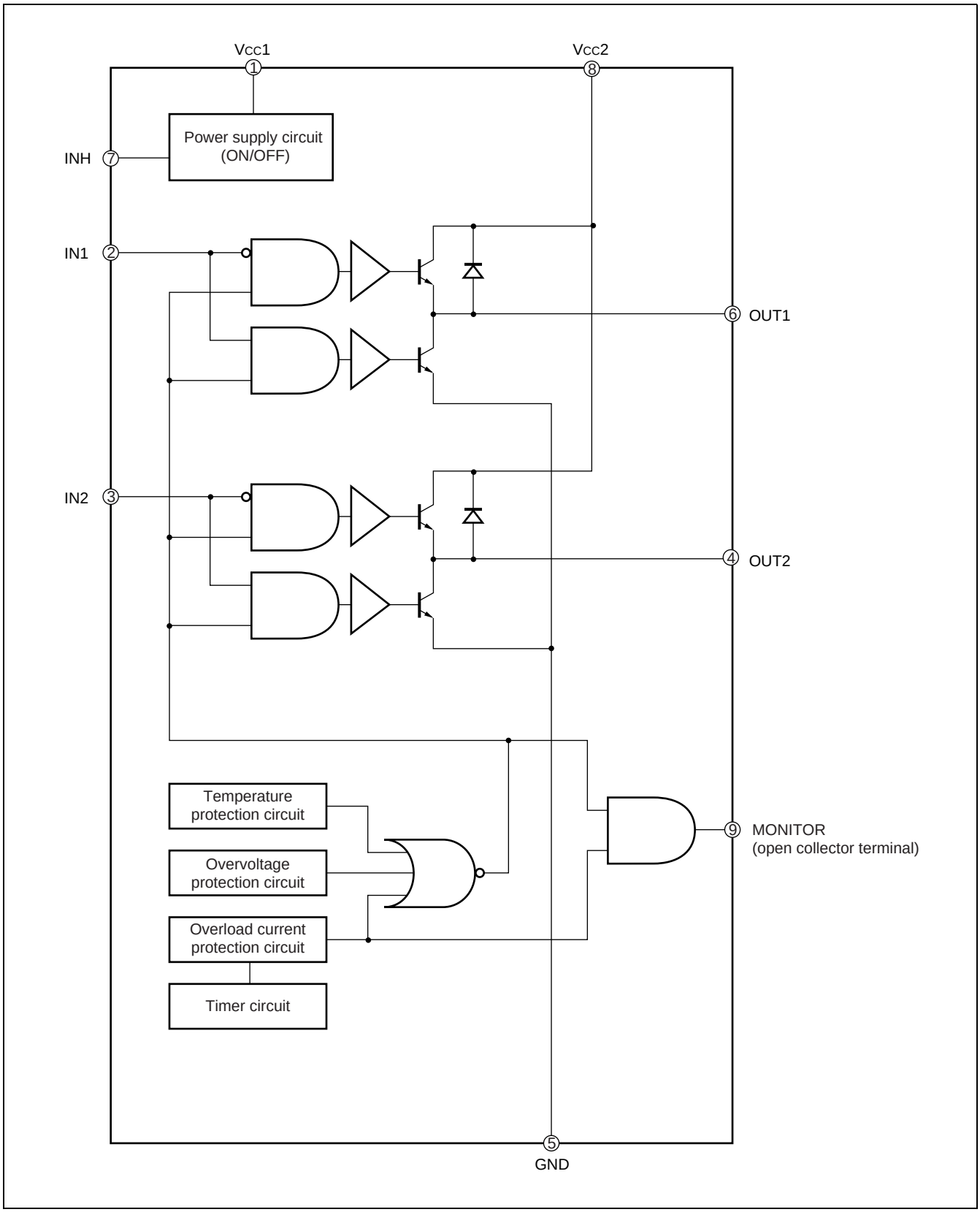


(SIP-9P-M02)

■ PIN DESCRIPTION

Pin no.	Symbol	I/O	Description
1	$V_{CC}1$	—	Control system power supply terminal
2	IN1	I	Load control signal input terminal 1
3	IN2	I	Load control signal input terminal 2
4	OUT2	O	Load control output terminal 2
5	GND	—	Ground terminal
6	OUT1	O	Load control output terminal 1
7	INH	I	Inhibitor signal input terminal
8	$V_{CC}2$	—	Output system power supply terminal
9	MONITOR	O	Protective circuit motor signal output terminal (open collector type terminal)

■ BLOCK DIAGRAM

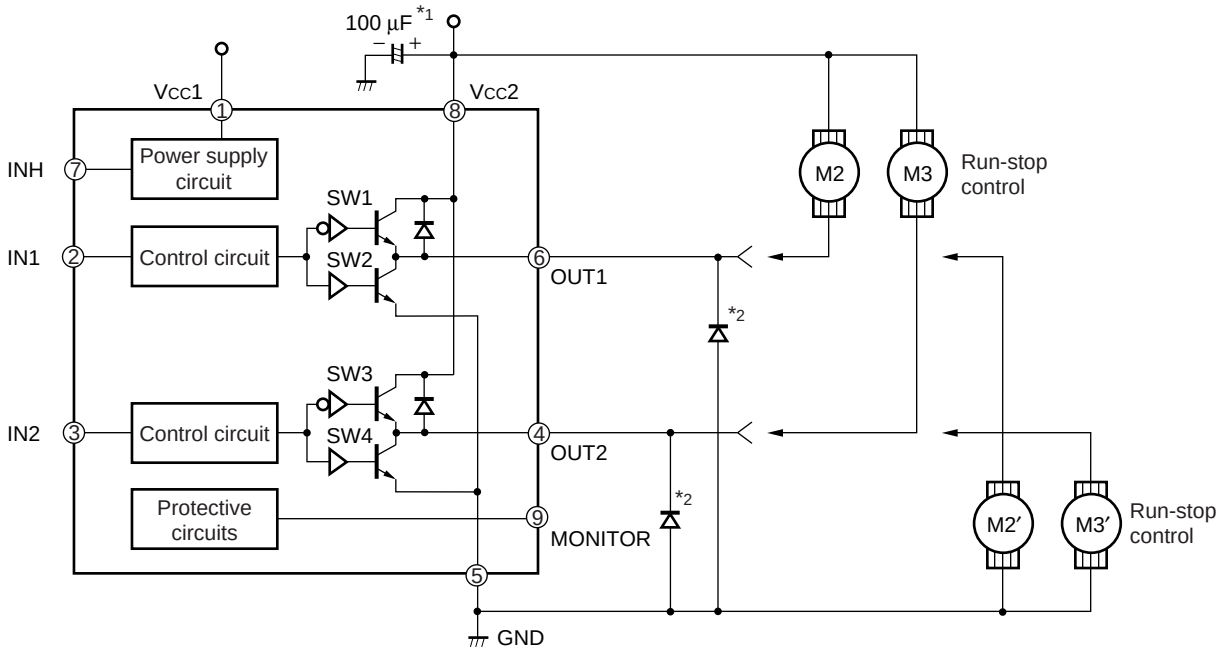


■ FUNCTIONAL DESCRIPTION

The MB3853 provides two methods for controlling motors. The IC can be connected to two motors and drive each motor independently, or connected to one motor in an H-type connection and drive the motor in forward and reverse directions.

1. Sample connection to 2 motors for run-stop control.

(1) Connection diagram



*1 : The capacitor should be placed close to the IC terminal.

*2 : When using the M2’ and M3’ terminals, ensure that the OUT1 terminal (pin 6) voltage and OUT2 terminal (pin 4) voltage do not fall below –0.3 V by connecting the OUT1 and OUT2 terminals to ground through a Shottky barrier diode.

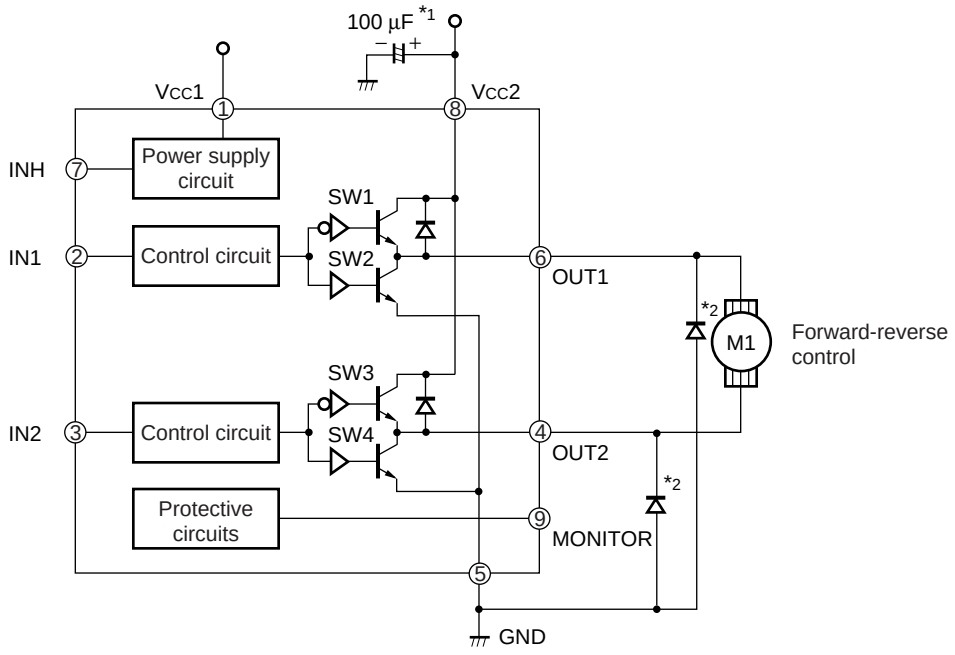
(2) Table of Functions

Mode	Input voltage level			Output terminals		Motor operating mode			
	INH	IN1	IN2	OUT1	OUT2	M2	M3	M2’	M3’
Inhibit mode	“L”	×	×	OFF (high impedance)		Continuous operation			
Mode (1)	“H”	“L”	“L”	“H”	“H”	Brake	Brake	Run	Run
Mode (2)		“L”	“H”	“H”	“L”	Brake	Run	Run	Brake
Mode (3)		“H”	“L”	“L”	“H”	Run	Brake	Brake	Run
Mode (4)		“H”	“H”	“L”	“L”	Run	Run	Brake	Brake

× : May be either “H” or “L” level

2. Sample connection to 1 motor for forward-reverse control

(1) Connection diagram



*1 : The capacitor should be placed close to the IC terminal.

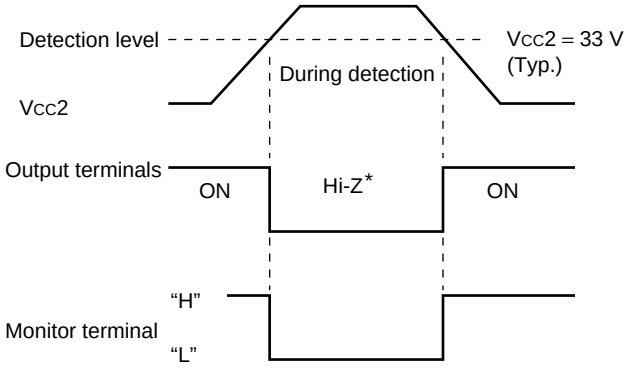
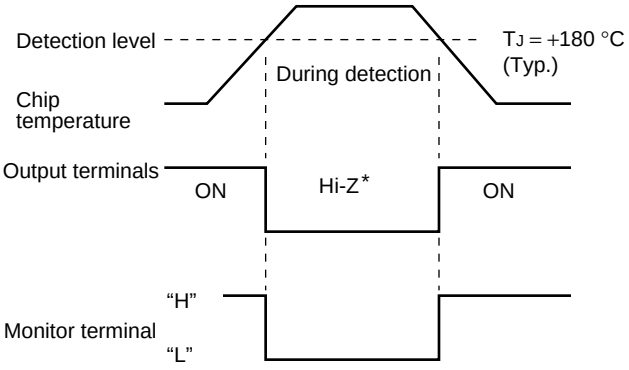
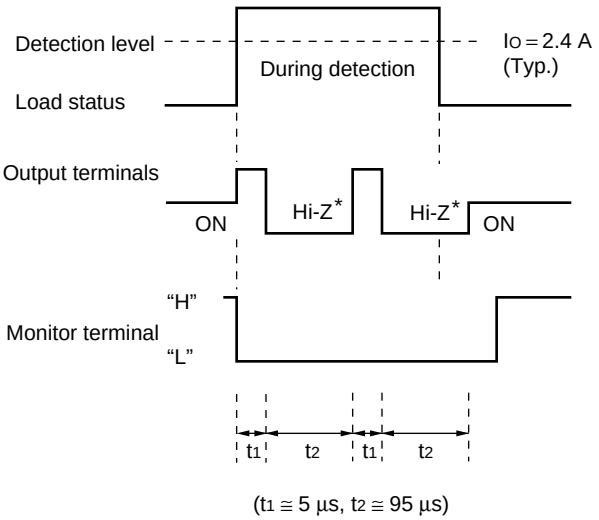
*2 : Ensure that the OUT1 terminal (pin 6) voltage and OUT2 terminal (pin 4) voltage do not fall below –0.3 V by connecting the OUT1 and OUT2 terminals to ground through a Shot key barrier diode.

(2) Table of functions

Mode	Input voltage level			Output terminals		Motor mode
	INH	IN1	IN2	OUT1	OUT2	
Inhibit mode	"L"	×	×	OFF (High impedance)		Continuous operation
Mode (1)	"H"	"L"	"L"	"H"	"H"	Brake
Mode (2)		"L"	"H"	"H"	"L"	Forward (reverse)
Mode (3)		"H"	"L"	"L"	"H"	Reverse (forward)
Mode (4)		"H"	"H"	"L"	"L"	Brake

× : May be either "H" or "L" level

■ PROTECTIVE CIRCUITS

Circuit name	Operating description	Timing chart
Overvoltage protection circuit	When the Vcc2 supply voltage input exceeds 33 V (Typ.) , the following occurs : (1) All output transistors are turned off, and output is set to high impedance (2) As long as the condition is detected, the monitoring output from the open collector terminal is set to “L” level.	
Temperature protection circuit	When the chip temperature exceeds T_J = +180 °C, the following occurs : (1) All output transistors are turned off, and output is set to high impedance (2) As long as the condition is detected, the monitoring output from the open collector terminal is set to “L” level.	
Overcurrent protection circuit	Monitors VBE of all output transistors. When any transistor output load current exceeds Io = 2.4 A (Typ.) , the following occurs : (1) All output transistors are switched on and off repeatedly (2) As long as the condition is detected, the monitoring output from the open collector terminal is set to “L” level.	

* : All output transistors are turned off regardless of logic input voltage.

■ ABSOLUTE MAXIMUM RATINGS

(GND = 0 V)

Parameter	Symbol	Condition	Rating		Unit
			Min.	Max.	
Supply voltage	$V_{CC}1$	—	—	30	V
	$V_{CC}2$	—	—	30	V
Surge voltage	$V_{CC\,(S)}$	$t_r \geq 1$ ms, $t_s \leq 200$ ms	—	60	V
Output current	I_O	10 ms or less per terminal	—	1.8	A
Power consumption	P_D	$T_C \leq +75$ °C	—	18	W
Operating temperature	T_C	—	–40	+85	°C
Storage temperature	Tstg	—	–55	+150	°C

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

■ RECOMMENDED OPERATING CONDITIONS

(GND = 0 V)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Supply voltage	$V_{CC}1$	Control system supply voltage	4.5	5	30	V
	$V_{CC}2$	Output system supply voltage	—	24	30	V
“H” level input voltage	V_{IH}	IN1, IN2, INH terminals	2.0	—	$V_{CC}1 + 0.3$	V
“L” level input voltage	V_{IL}		–0.3	—	0.8	V
Operating temperature	T_C	—	0	25	70	°C

WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device’s electrical characteristics are warranted when the device is operated within these ranges.

Always use semiconductor devices within their recommended operating condition ranges. Operation outside these ranges may adversely affect reliability and could result in device failure.

No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their FUJITSU representatives beforehand.

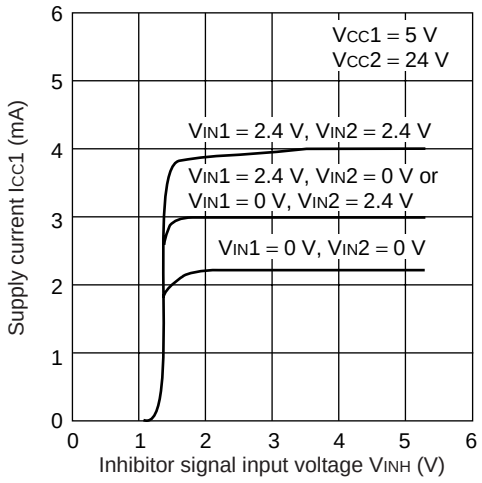
■ ELECTRICAL CHARACTERISTICS

(T_C = +25 °C, GND = 0 V, $V_{CC}1$ = 5 V, $V_{CC}2$ = 24 V)

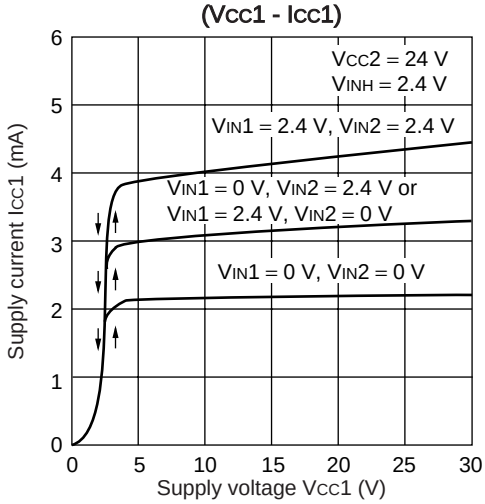
Parameter		Symbol	Conditions	Values			Unit
				Min.	Typ.	Max.	
"L" level input current		I_{IL}	V_{IL} = 0.4 V	—	—	100	µA
"H" level input current		I_{IH}	V_{IH} = 2.4 V	—	—	100	µA
"L" level output current		V_{OL}	I_O = 1 A	—	1.0	1.4	V
"H" level output current		V_{OH}	I_O = –1 A	22.5	23.0	—	V
Diode forward voltage		V_F	I_O = 1.8 A	—	2.2	—	V
Overcurrent detection current		I_{CS}	—	1.8	2.4	3.5	A
Overcurrent detection voltage		V_{SD}	—	30.5	33.0	35.5	V
"L" level monitoring output voltage		V_{OL}	I_O = 1 mA	—	0.2	0.4	V
"H" level monitoring output current		I_{OH}	V_{OH} = 24 V	—	—	0.01	mA
Supply current		$I_{CC}1$	IN1 = IN2 = "H"	—	3.7	7.4	mA
			IN1/IN2 = "H/L"	—	2.8	5.6	mA
			IN1 = IN2 = "L"	—	1.9	3.8	mA
		$I_{CC}2$	IN1 = IN2 = "H"	—	—	1.0	mA
			IN1/IN2 = "H/L"	—	13	20	mA
			IN1 = IN2 = "L"	—	26	40	mA
		$I_{CC}0$	$I_{CC}1$ + $I_{CC}2$ INH = "L"	—	—	1.0	mA
Package thermal resistance		θ_{J-C}	Infinite heat dissipation	—	4	—	°C/W
Power consumption	OUT1 or OUT2, per terminal	P_D	I_O = 1 A	—	1.2	—	W
			I_O = 0 mA (braking)	—	300	—	mW
	In H-type drive configuration		I_O = 1 A	—	2.4	—	W

■ TYPICAL CHARACTERISTIC

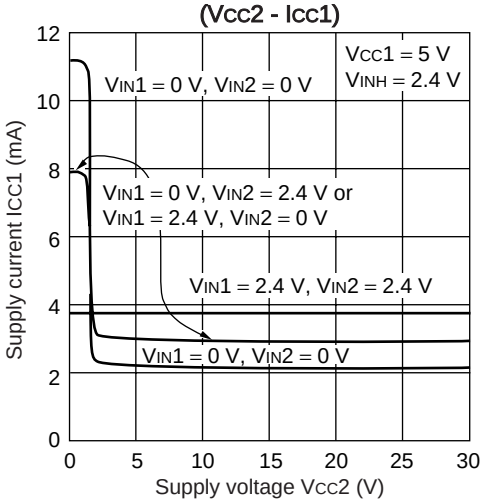
Supply current vs. inhibitor terminal input voltage



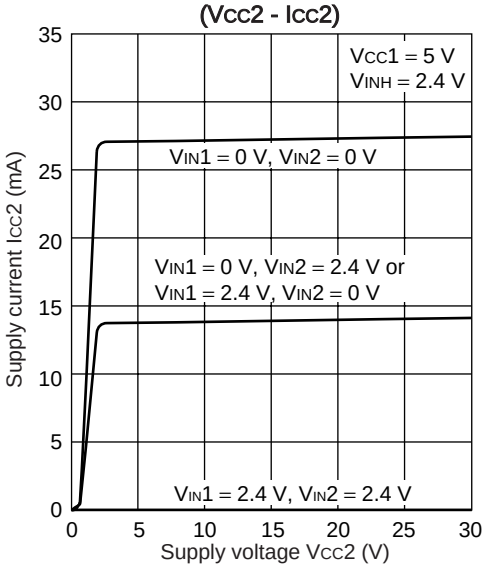
Supply voltage vs. supply current (Vcc1 - Icc1)



Supply voltage vs. supply current (Vcc2 - Icc1)



Supply voltage vs. supply current (Vcc2 - Icc2)



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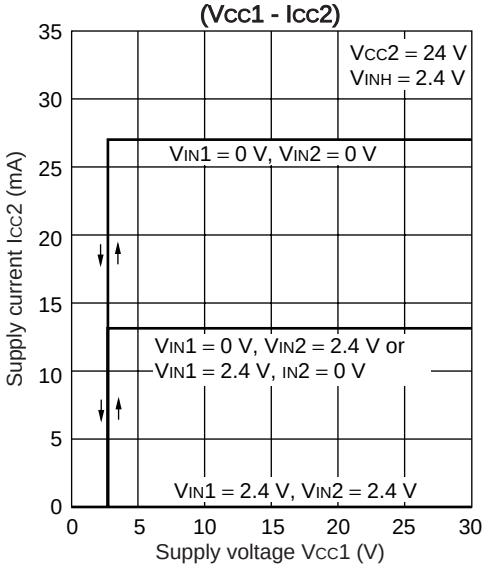
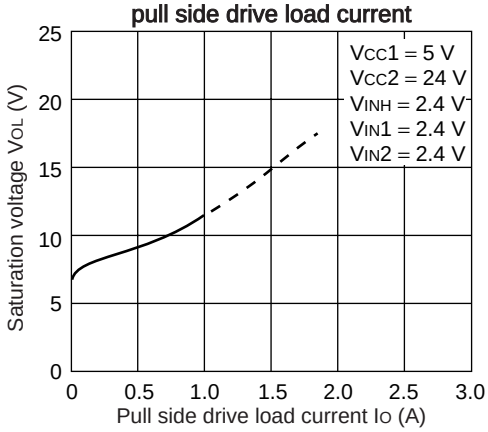
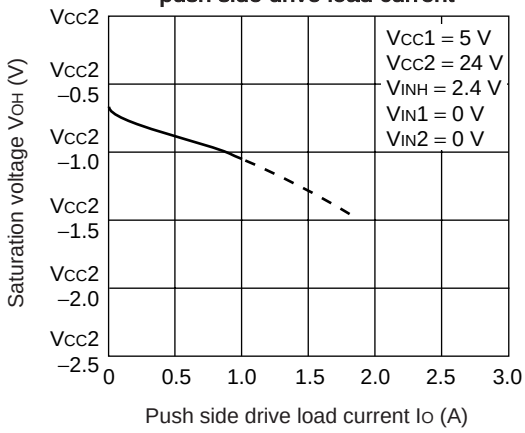
Supply voltage vs. supply current
(Vcc1 - Icc2)



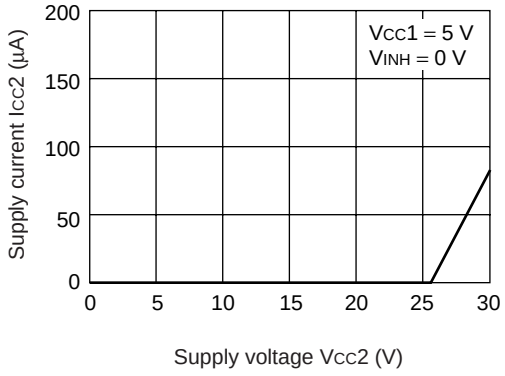
Saturation voltage vs.
pull side drive load current



Saturation voltage vs.
push side drive load current



Standby supply voltage vs. supply current
(Vcc2 - Icc2)



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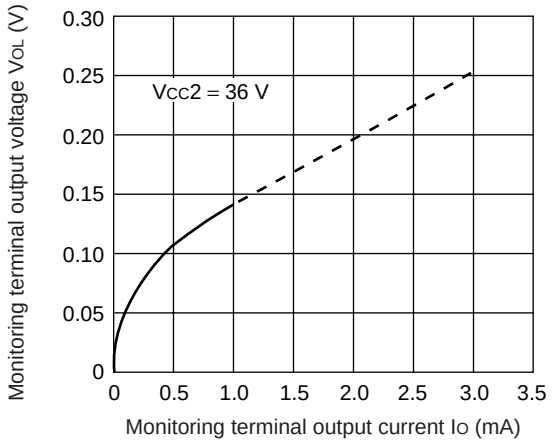
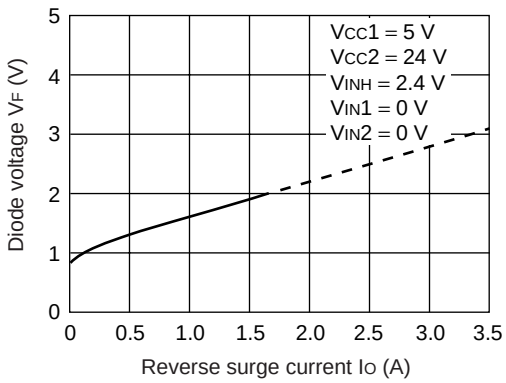
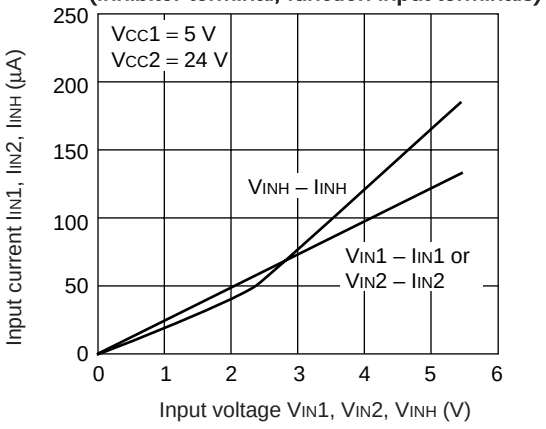
Monitoring terminal output current vs. output voltage



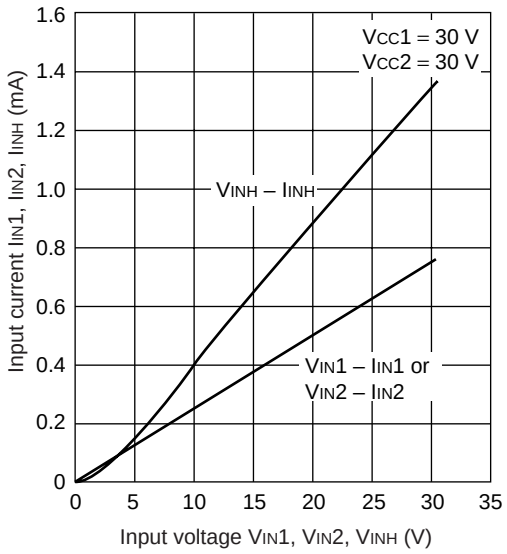
Flyback diode voltage vs. reverse surge current



Input current vs. input voltage (Inhibitor terminal, function input terminals)



Input current vs. voltage characteristics at maximum applied voltage (Inhibitor terminal, function input terminals)



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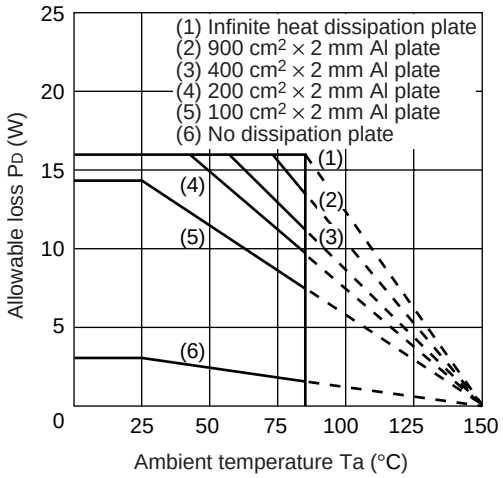
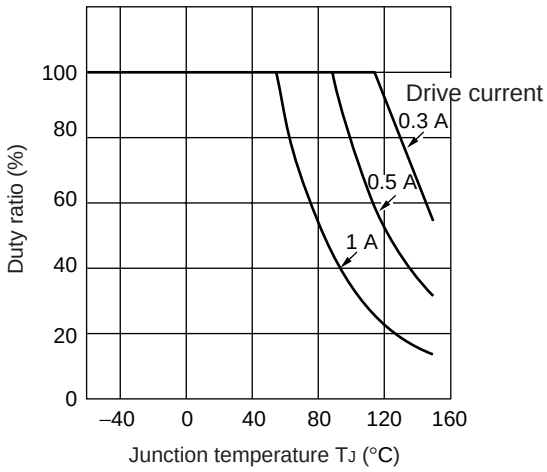
Allowable loss vs. Ambient temperature



Junction temperature vs. duty ratio



Notes : • For stable operation over periods of extended usage, the duty ratio should be kept below the characteristic curve.

• Junction temperature should be maintained at $T_J \leq +150$ °C.

(Tj calculation)

$T_J = T_C + \Delta T$

$\Delta T = 4$ (°C/W) $\times P_{DI}$

$P_{DI} = V_{CC} \times I_{CC} + \Delta V_O \times I_O$

$\Delta V_O = (V_{CC} - V_{OH}) + V_{OL}$

T_C : case temperature, ΔT : difference between case and junction temperature

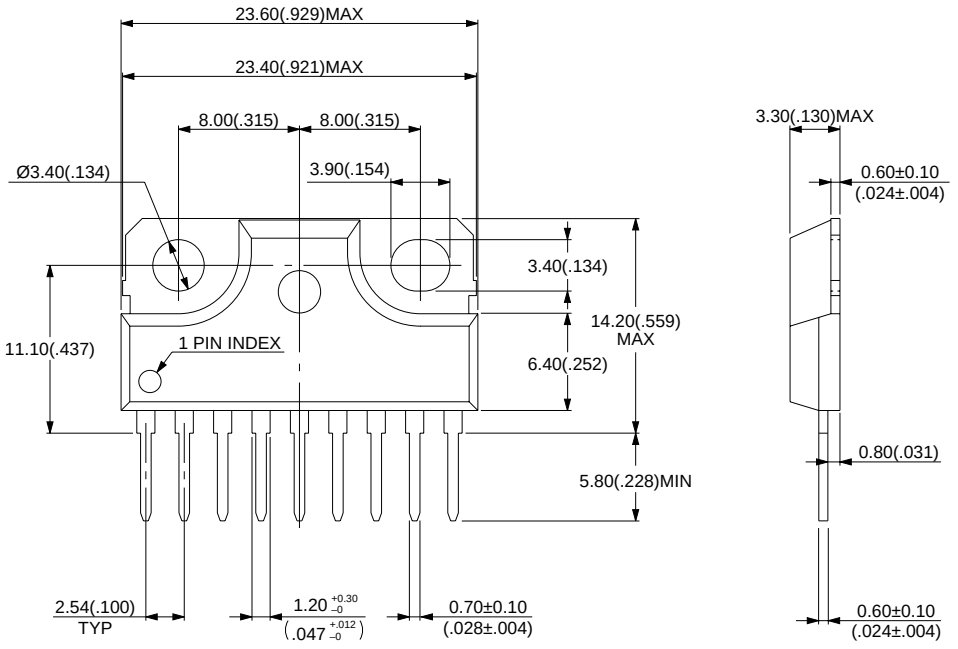
P_{DI} : IC power consumption (W)

■ ORDERING INFORMATION

Part Number	Package	Remarks
MB3853PS	Plastic SIP, 9 pins (SIP-9P-M02)	

■ PACKAGE DIMENSION

9-pin plastic SIP
(SIP-9P-M02)



Dimensions in mm (inches) .

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